PATENT SPECIFICATION

761614

Date of Application and filing Complete Specification: July 22, 1954.

No. 21361/54.

Application made in Germany on Sept. 15, 1953.

Complete Specification Published: Nov. 14, 1956.

Index at acceptance:—Class 86, C(1:8:13:18E3E:18G4B).

COMPLETE SPECIFICATION

Improved Mixing and Kneading Machine

I, ERNST ALFRED REIFFEN, a German National, of 6, Kirchestrasse, Kassel-Wilhelmshoehe, Germany, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention concerns a mixing and kneading machine in which an especially effective and peculiar processing of the material to be treated takes place.

According to the present invention, in an annular space between a rotor disposed concentrically in a generally cylindrical mixing container and having its shaft parallel to the axis of the container and the wall of the vessel, kneading rolls are arranged which rotate in the direction opposite to and with an angular speed lower than that of the rotor, and the axis of each kneading roll has relative angular movement, with respect to the container, in the direction opposite to the direction of rotation of the rotor.

According to one aspect of the invention, this relative motion can be produced in such a manner that the kneading rolls are caused to rotate through the annular space between rotor and container wall in the direction opposite to the rotation of the rotor and the container being stationary. According to one modification of the invention, the container rotates in the same sense as the rotor and the axes of the kneading rolls maintain their position and are not rotated through the annular space between rotor and container wall.

The rotor and the kneading rolls subject the material to be treated to continually reciprocating effects.

This reciprocal action is based on the fact that the kneading rolls feed the material to be treated from the peripheral zones of the container towards the rotor which, due to its higher peripheral speed, impresses on the material to be treated a motion again directed outwards.

In the zone of pressure building up between the kneading rolls and the rotor, the material to be treated is subjected to a kneading process whereby it is first compressed and then drawn apart again.

The material crowds together before the feeding zone of the kneading rolls and leaves the kneading rolls at the rear with a differentiated speed, due to the higher speed of the rotor. There it enters a lee-side space formed more or less behind the kneading rolls, as seen in the direction of flow, and is impelled towards the container wall according to its consistency.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:—

Fig. 1 is a vertical section of one embodiment of mixing and kneading machine constructed in accordance with the invention,

Fig. 2 is a horizontal section thereof on the line II—II of Fig. 1,

Fig. 3 is a vertical section of a modified embodiment,

Fig. 4 is a horizontal section on the line IV—IV of Fig. 3,

Fig. 5 is a plan view of a modification of the rotor,

Fig. 6 is a side view of the rotor shown in Fig. 5,

Fig. 7 is a plan view of another modification of the rotor with the kneading rolls, partially in a horizontal section,

Fig. 8 is a vertical section of the rotor and rolls shown in Fig. 7,

Fig. 9 shows another modification of the kneading rolls,

Fig. 10 is a simplified representation in plan view of the rotor together with still another form of the kneading rolls, and

Fig. 11 a vertical section thereof.

With reference to Figs. 1 and 2, a rotor 2 is arranged concentrically in a generally cylindrical stationary mixing container 1. A rotor shaft 4 mounted in a frame 3 is driven through a belt drive 5 by a motor flanged to the frame 3.

On either side of rotor 2, are disposed kneading rolls 7 which are mounted eccentrically on their shafts 8.

Shafts 8 are supported in a yoke 9 which

can turn on a bushing 10 fixed to the machine frame 3 and which surrounds the rotor shaft 4.

The kneading rolls 7 are driven through spur gears 11 mounted on their shafts 8 and meshing with a spur gear 12 seated on the rotor shaft 4. A pinion 13 is mounted on each feeding roll shaft 8 above the spur gear 11. The two pinions 13 mesh with a ring gear 14 fastened to the bushing 10 and thus fixedly connected with the machine frame 3.

As the ring gear 14 is stationary, the pinions 13 revolve thereabout 14, when the kneading rolls 7 rotate and take the rotary yoke 9 along with them.

Thereby, a planetary rotation of the kneading rolls 7 around the rotor 2 within the annular space between said rotor and container wall is effected.

In Fig. 2 the direction of rotation of the rotor is indicated by the arrow 15; the direction of the planetary rotation of the kneading rolls 7, which is opposite to the direction of rotation of the rotor, by the arrows 16, and the direction of rotation of the kneading rolls 7 which is also opposite to that of the rotor, by arrows 17.

In front of the operating area of the kneading rolls, as seen in the direction of flow of the material, wall scrapers 18 are provided, which are attached to yoke 9 and accordingly turn together with it in the direction of the arrow 16, that is in the sense of the planetary rotation of the kneading rolls.

These wall scrapers scrape the container wall, increase the crowding of the mass of material being treated in front of the kneading rolls and guide the crowded mass to the operating area of the kneading rolls.

To the bottom of the container 1 is fastened a scraper 19 which extends into the space between the rotor and the rotating kneading rolls and stops revolving lumps of the mass so that they can be seized by the kneading rolls.

20 designates a scraping tool also fastened to the bottom of the container and thus stationary, which scrapes the rotor 2.

In the modification as shown in Fig. 3 and 4, the kneading rolls 7 are not rotated with the yoke. Instead, container 21 rotates so that accordingly the same relative motion between the rotor 2, the kneading rolls 7 and the container wall prevails.

The shaft end of container 21 is mounted in a bearing in the housing cover 23. It is driven by a motor shaft 24 through a gear train consisting of the three pairs of bevel gears 25, 26, 27.

Also the rotor shaft 4 is driven by the motor shaft 24 through a pair of bevel gears 28.

The yoke 29, in which the shafts 8 of the kneading rolls 7 are supported, is fastened to the machine frame and is therefore stationary. On the shafts 8, spur gears 11 are again seated which mesh with the spur gear 12 mounted on the rotor shaft 4 and rotate, therefore, in the direction opposite to that of the rotor 2 as indicated by the arrows 15 and 17 in Fig. 4. Wall scrapers 30 are stationarily fixed on the stationary yoke 29. Due to the rotation of the container the same crowding effect and the deviation of the flowing mass to the operating area of the kneading rolls 7 prevail as with the arrangement according to Fig. 1 and 2.

Correspondingly, the scraper 19 fastened to the bottom of the container and also rotating together with the rotary container in the direction of arrow 31 produces the same effect as regards the feeding of lumps into the operating area of the kneading rolls as with the embodiment according to Fig. 1 and 2.

A scraper 32 is fastened to the stationary yoke 29.

In order that the kneading rolls mounted eccentrically on their shafts may scrape the entire bottom area within their operating range, the ratio of transmission between the pinions 11 and the central gear 12 is suitably chosen so that the kneading rolls continually change their path of motion in relation to the container bottom. In this modification the scrapers 19 are omitted.

To intensify its effects, the rotor 2 can be provided with beater cams. Fig. 5 and 6 show such a rotor with four beater cams 33 pointing obliquely upwards, that is inclined to the perpendicular, which give the material to be treated an upward motion.

In the embodiment as shown in Fig. 7 and 8, the rotor is composed of discs 34, similar to the blades of a milling cutter, and which are seated on the rotor shaft 4 spaced above each other.

The teeth 35 of the milling discs whip through the gaps of stationary comb bodies 36. These comb bodies are mounted on a part of the machine which, in relation to the kneading rolls, is stationary, namely on the yoke 29 as in the embodiment according to Fig. 3 and 4 or on the yoke 9 as in the embodiment according to Fig. 1 and 2.

With each comb body 36, there is associated a kneading roll 7 which is located in front of the comb body as seen in the direction of rotation of the rotor (arrow 15).

Such an arrangement of toothed discs and comb-like member is set forth in my earlier Specification No. 680,309 but in that case the rotor was mounted eccentrically to the container. In the present invention the rotor is concentrically disposed in the container and the kneading rolls are symmetrically mounted in the annular space between the rotor and the container wall. This results in substantial advantages. Dead spaces in the container are prevented and, furthermore, the kneading rolls operate uniformly on the material to be mixed. Moreover, it is possible for any number of kneading rolls to be arranged in the said

annular space.

Instead of kneading rolls which are cylindrical or conical over their entire height and mounted eccentrically on their shafts, rolls may also be employed partitioned in their height and composed of several discs staggered relative to each other.

Fig. 10 and 11 show kneading rolls which consist of three discs 37, 38, 39 equally spaced at an angle of 120°. Such a disc roll is balanced, affording quiet running. Furthermore, the blows of impact against the container wall and the rotor, which occur, when the material is compressed, are lighter due to the lower height of instantaneously heating roll surface at a correspondingly higher number of impacts.

A still greater balancing of the impact is accomplished by means of a screw like kneading roll 40 according to Fig. 9 which is mounted concentrically on its shaft 8.

What I claim is:—

1. A mixing and kneading machine in which in an annular space between a rotor disposed concentrically in a generally cylindrical mixing container and having its shaft parallel to the axis and the wall of the container, kneading rolls are inserted which rotate in a direction opposite to and with a smaller angular speed than that of the rotor, and the axis of each kneading roll has relative angular movement with respect to the container, in the direction opposite to the direction of rotation of the rotor.

2. A machine as claimed in claim 1 in which the kneading rolls are caused to rotate through the annular space between the rotor and the container wall in the opposite direction to the rotation of the rotor.

3. A machine according to claim 1 in which the container rotates in the same direction as the rotor and the axes of the kneading rolls keep their position.

4. A machine as claimed in claims 1 to 3 in which gear wheels fixed on the shafts of the kneading rolls engage with a central wheel fixed on the rotor shaft.

5. A machine as claimed in claim 4 in which the gear ratio between gear wheels and the centre wheel is so chosen that the kneading rolls fixed eccentrically on their shafts constantly change their path of motion relative to the bottom of the container.

6. A machine as claimed in claims 1 and 2 in which the shafts of the kneading rolls are mounted in a yoke, which is rotatable around a bush surrounding the rotor shaft and attached to the frame of the machine, and on which is fixed a ring gear with which is meshed a pinion arranged on the shaft of each kneading roll.

7. A machine as claimed in claims 1 and 3 in which the shafts of the kneading rolls are mounted in a yoke fixedly secured to the frame of the machine.

8. A machine as claimed in claims 1 to 3, in which wall scrapers are arranged in front of the operating area of the kneading rolls as seen in the direction of flow of the material to be mixed, and these wall scrapers in the case of the stationary container and rotating kneading rolls are attached to the rotatable yoke bearing of the kneading rolls, and in the case of the rotating container are attached to the stationary yoke.

9. A machine as claimed in claims 1 to 3 in which the rotor is provided on its circumference with obliquely upwardly directed beating cams inclined relative to the vertical.

10. A machine as claimed in claims 1 to 3 in which the rotor is composed of discs similar to milling cutters spaced above one another and attached to the rotor shaft, whose teeth pass through the gaps of stationary comb bodies which are attached to a part of the machine which does not change its position with respect to the kneading rolls.

11. A machine as claimed in claims 1 to 3 in which a scraper is provided which is attached to the bottom of the container and projects into the space between the rotor and the kneading rolls.

12. A machine as claimed in claims 1 to 3 in which the kneading rolls consist of discs fixed eccentrically on the shaft and staggered relative to each other, so that their mass is balanced.

13. A machine as claimed in claims 1 to 3 including a spirally-shaped kneading roll fixed concentrically on the shaft.

14. Mixing and kneading machines constructed and arranged substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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8, Hackins Hey, Liverpool, 2.
Chartered Patent Agents.

Leamington Spa: Printed for Her Majesty's Stationery Office, by the Courier Press.—1956.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

Fig.1

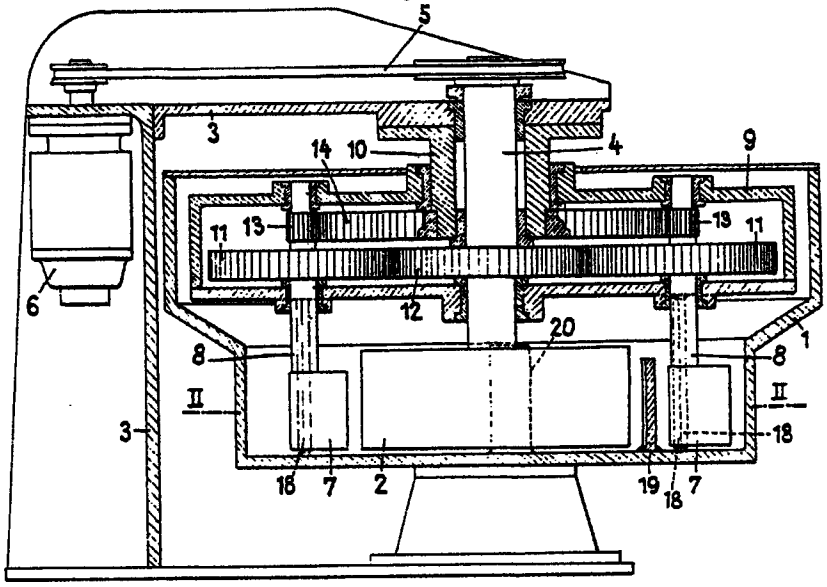
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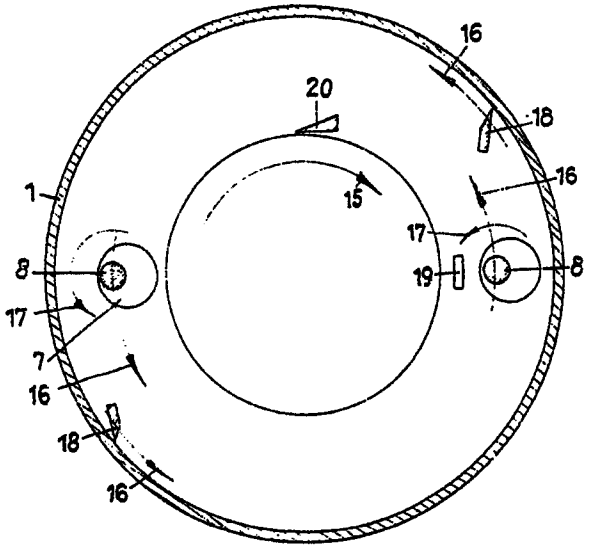
Fig.2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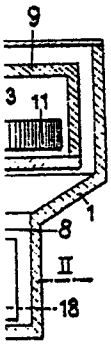
SHEETS 1 & 2



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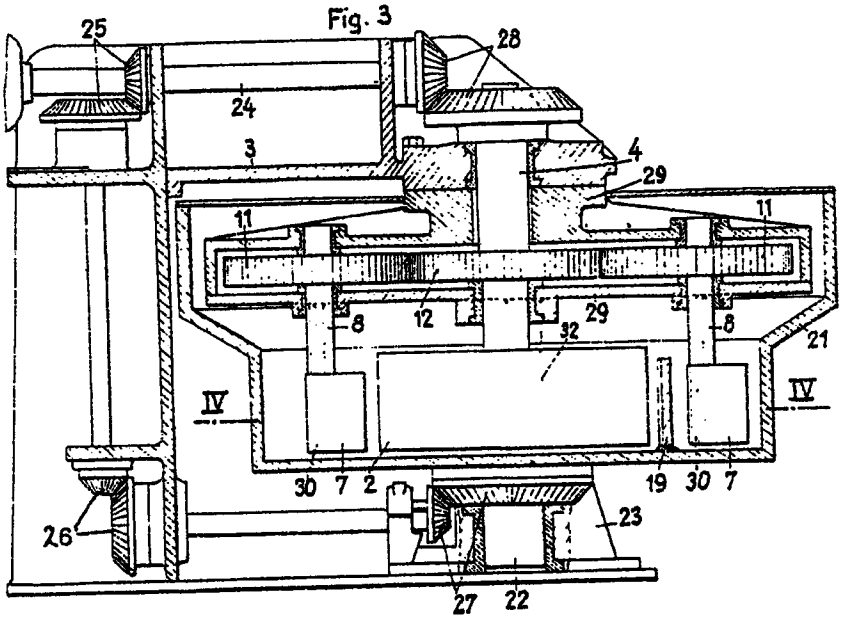

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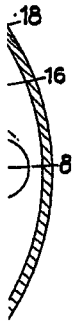

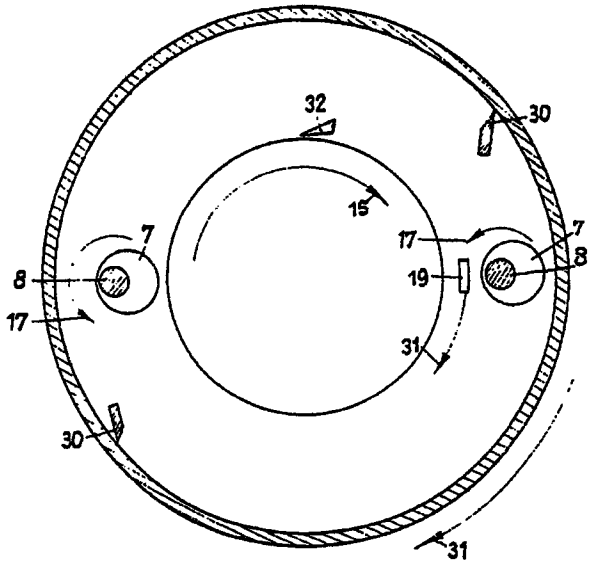

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SHEETS 1 & 2

Fig. 1

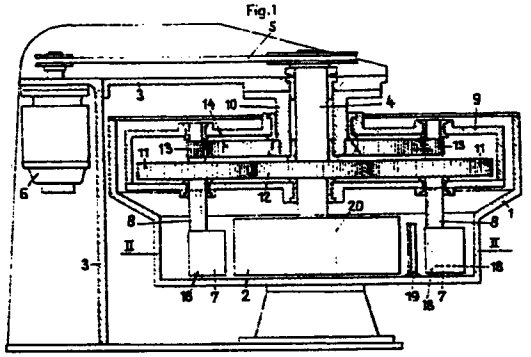
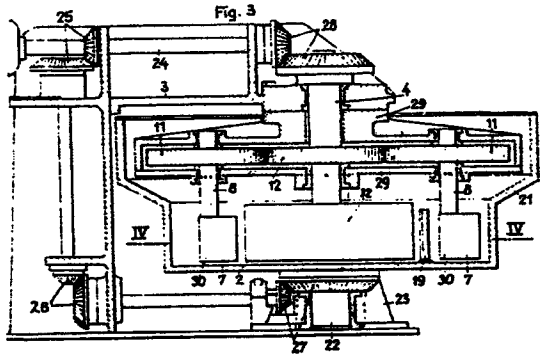


Fig. 3



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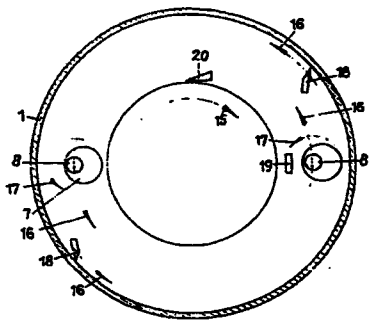


Fig. 4

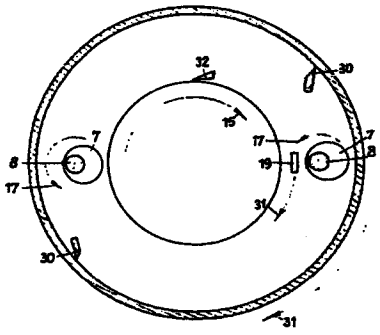


Fig.5

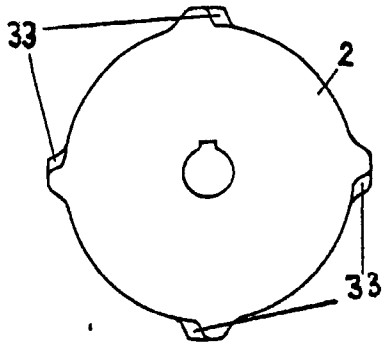


Fig.6

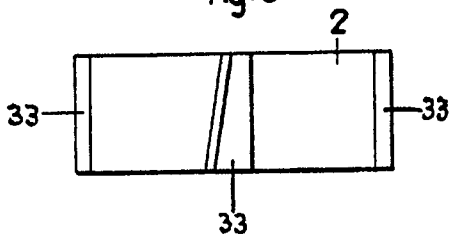


Fig.7

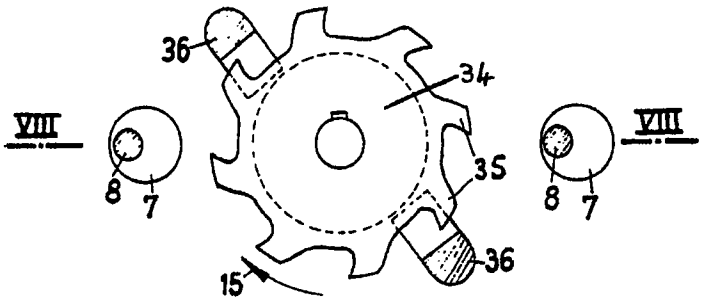
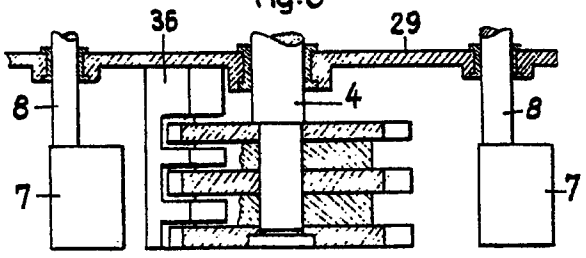


Fig.8



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SHEETS 3 & 4

Fig. 9

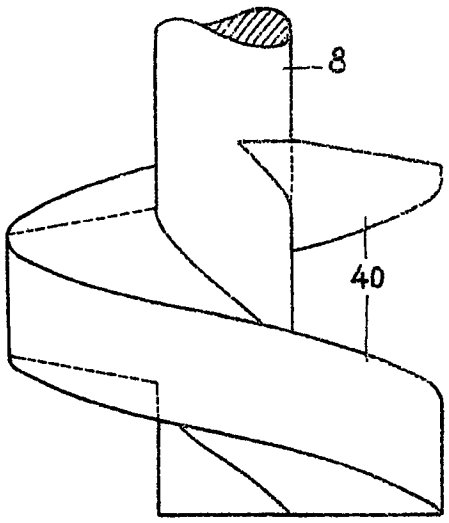
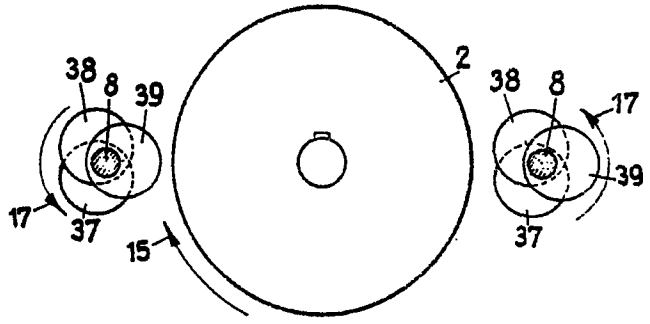
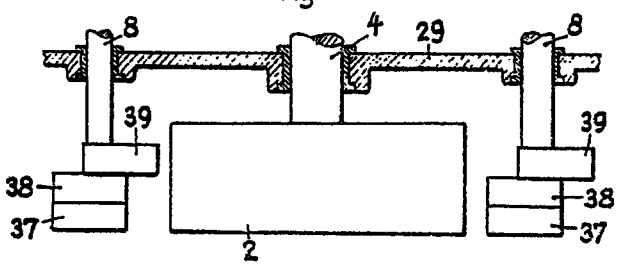


Fig. 10



VIII

Fig. 11



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SHEETS 2 & 4

Fig.5

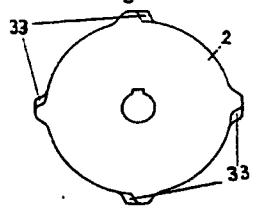


Fig.6

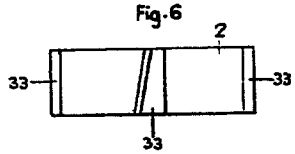
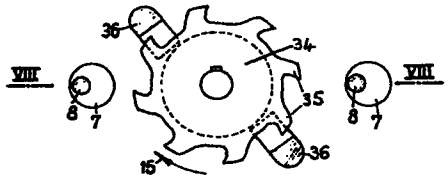


Fig.7



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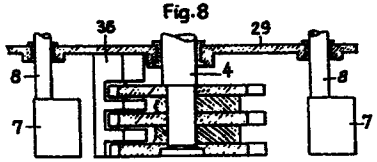

Fig.9

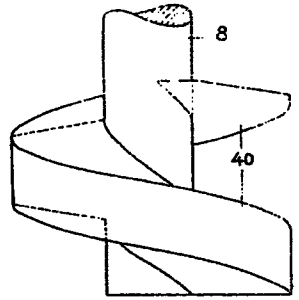

Fig.10

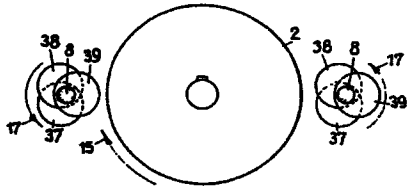

Fig.11